TOXICOLOGICAL REVIEW OF TRIBUTYLTIN

This appendix provides a brief toxicological overview of TBT, which is one of several organotin compounds that have been used as biocides, disinfectants, and antifoulants. This overview primarily discusses tributyltin oxide (TBTO) because this is the only TBT compound for which the USEPA has established a reference dose (RfD) for assessing chronic toxicity to humans, and because more toxicological information is available for this compound than for other organotin compounds.

BACKGROUND

TBTO is an organotin compound used primarily as a biocide and as a biocidal preservative for wood, cotton, textiles, paper, and paints and stains for residential homes. It is also used as an antifoulant agent in marine paints, which may contain as much as 20 percent TBTO, to prevent the attachment and growth of barnacles, plankton, algae, and other organisms to ship hulls. The tributyl compounds registered for use as anitfoulants include TBTO, TBT adipate, TBT dodecenyl succinate, TBT sulfide, TBT acetate, TBT acrylate, TBT fluoride, TBT methacrylate, and TBT resinate (USEPA 1997).

PHARMACOKINETICS

No studies are available regarding the distribution of tin in human tissues following oral exposure (ATSDR 1992). Laboratory studies with mammals have shown that organotin compounds are absorbed; studies with rats detected tin compounds in the gastrointestinal tract, kidney, and liver (USEPA 1997). Rats that orally ingested tin compounds showed the highest concentrations in the liver and kidneys; concentrations in the brain and adipose tissue were 10 to 20 percent of those found in the kidneys and liver (Krajnc et al. 1984). Studies involving trialkyltin compounds show that absorbed compounds are metabolized, with the data suggesting that the liver is the active site and dealkylation the principle metabolic pathway (USEPA 1997; ATSDR 1992).

ACUTE TOXICITY

There are no controlled studies on the effects of TBTO in humans (USEPA 1997). The available data demonstrate that TBT is toxic to animals, with LD_{50} values ranging from 122 to 194 μg/g in rats (USEPA 1997).

CHRONIC TOXICITY

USEPA's IRIS (1997) database provides an RfD for TBTO of 3.0×10^{-4} μg/g/day, based on a no observed adverse effects level of 0.025 μg/g/day and an uncertainty factor of 100. This was based on a chronic feeding study of rats in which immunologic function analyses for specific and nonspecific resistance were performed after 4–6 or 15–17 months of exposure to test doses of TBTO ranging from 0.025 to 2.5 μg/g/day (Vos et al. 1990). The uncertainty factor of 100 is the product of a factor of 10 for uncertainty associated with extrapolating from a laboratory animal species to humans, and a factor of 10 to protect sensitive humans (IRIS 1997).

DEVELOPMENTAL TOXICITY

No studies are available on developmental effects of TBTO in humans (USEPA 1997).

CARCINOGENICITY

TBTO is currently Class D, not classifiable as to human carcinogenicity (IRIS 1997). There are no data concerning development of cancer in humans following exposure to TBTO. A large number of studies show that TBTO is not genotoxic, and there are no structure-activity relationships suggesting that TBTO might be a carcinogen (IRIS 1997).

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